

What is claimed is:

1. An immersion nozzle for continuous casting of steel, said immersion nozzle supplying molten steel into a mold, characterized in that at least a part of the immersion nozzle is formed of a refractory having a desulfurizing ability.
2. The immersion nozzle according to claim 1, characterized in that the refractory having a desulfurizing ability is disposed at an internal portion of the nozzle which is brought into contact with the molten steel.
3. An immersion nozzle for continuous casting of steel, said immersion nozzle supplying molten steel into a mold, characterized in that at least a part of the immersion nozzle is formed of a refractory which comprises a refractory material including an oxide and a component to reduce the oxide, the oxide containing an alkaline earth metal.
4. The immersion nozzle according to claim 3, characterized in that the oxide containing an alkaline earth metal primarily comprises MgO , and the component

reducing the oxide is at least one metal selected from the group consisting of Al, Ti, Zr, Ce, and Ca.

5. The immersion nozzle according to claim 4,

characterized in that the content of the MgO in the refractory is 5 to 75 mass percent, and the content of said at least one metal selected from the group consisting of Al, Ti, Zr, Ce, and Ca is 15 mass percent or less.

6. The immersion nozzle according to claim 4 or 5,

characterized in that the refractory further comprises carbon.

7. The immersion nozzle according to claim 6,

characterized in that the content of said at least one metal selected from the group consisting of Al, Ti, Zr, Ce, and Ca in the refractory is 15 mass percent or less, the content of the MgO is 5 to 75 mass percent, and the content of the carbon is 40 mass percent or less.

8. The immersion nozzle according to any one of claims 4 to 7, characterized in that the oxide containing an alkaline earth element contains CaO.

9. The immersion nozzle according to claim 8,
characterized in that the content of the CaO in the
refractory is 5 mass percent or less.
10. An immersion nozzle for continuous casting of steel,
said immersion nozzle supplying molten steel into a mold,
characterized in that at least a part of the immersion
nozzle is formed of a refractory which comprises a
refractory material including MgO and an Al metal.
11. The immersion nozzle according to claim 10,
characterized in that the content of the MgO in the
refractory is 5 to 75 mass percent, and the content of the
Al metal is 1 to 15 mass percent.
12. The immersion nozzle according to claim 11,
characterized in that the content of the Al metal in
the refractory is 2 to 15 mass percent.
13. The immersion nozzle according to claim 12,
characterized in that the content of the Al metal in
the refractory is 5 to 10 mass percent.
14. The immersion nozzle according to any one of claims 10
to 13, characterized in that the refractory further

comprises carbon.

15. The immersion nozzle according to claim 14,

characterized in that the content of the carbon in the refractory is 40 mass percent or less.

16. The immersion nozzle according to any one of claims 10 to 15, characterized in that the refractory material further includes CaO.

17. The immersion nozzle according to claim 16,

characterized in that the content of the CaO in the refractory is 5 mass percent or less.

18. The immersion nozzle according to any one of claims 3 to 17, characterized in that the refractory material further includes at least one selected from the group consisting of Al_2O_3 , SiO_2 , ZrO_2 , and TiO_2 .

19. An immersion nozzle for continuous casting of steel, said immersion nozzle supplying molten steel into a mold,

characterized in that at least a part of the immersion nozzle is formed of a refractory which comprises a refractory material including spinel ($\text{MgO} \cdot \text{Al}_2\text{O}_3$) and at least one metal selected from the group consisting of Al, Ti,

Zr, Ce, and Ca.

20. The immersion nozzle according to claim 19,
characterized in that the content of the spinel
($\text{MgO} \cdot \text{Al}_2\text{O}_3$) in the refractory is 20 to 99 mass percent, and
the content of said at least one metal selected from the
group consisting of Al, Ti, Zr, Ce, and Ca is 15 mass
percent or less.
21. The immersion nozzle according to claim 19 or 20,
characterized in that the refractory further comprises
carbon.
22. The immersion nozzle according to claim 21,
characterized in that the content of the carbon in the
refractory is 40 mass percent or less.
23. The immersion nozzle according to any one of claims 19
to 22, characterized in that the refractory material further
includes CaO .
24. The immersion nozzle according to claim 23,
characterized in that the content of the CaO in the
refractory is 5 mass percent or less.

25. The immersion nozzle according to any one of claims 19 to 24, characterized in that the refractory material further includes at least one selected from the group consisting of MgO, Al₂O₃, SiO₂, ZrO₂, and TiO₂.

26. The immersion nozzle according to any one of claims 3 to 25, characterized in that the refractory is disposed at an internal portion of the nozzle which is brought into contact with the molten steel.

27. The immersion nozzle according to any one of claims 3 to 26, characterized in that the refractory has a desulfurizing ability.

28. An immersion nozzle for steel continuous casting, comprising the refractory according to any one of claims 1 to 27; and a supporting refractory which supports said refractory.

29. An immersion nozzle for continuous casting of steel, said immersion nozzle supplying molten steel into a mold, characterized in that a molten-steel introducing port is formed to inject a gas having a desulfurizing ability from an inner wall surface thereof, part of the molten steel flowing through the molten-steel introducing port is

desulfurized by the injected gas having a desulfurizing ability, said part of the molten steel being present at the inner wall surface portion.

30. The immersion nozzle according to claim 29, characterized in that the gas having a desulfurizing ability is at least one gas of Mg gas, Ca gas, Mn gas, and Ce gas.

31. An immersion nozzle for continuous casting of steel, said immersion nozzle supplying molten steel into a mold, characterized in that a molten-steel introducing port is formed to inject at least one gas of Mg gas, Ca gas, Mn gas, and Ce gas from an inner wall surface of the molten-steel introducing port, wherein said at least one gas is injected to the molten steel flowing through the molten-steel introducing port.

32. An immersion nozzle for continuous casting of steel, said immersion nozzle supplying molten steel into a mold, the immersion nozzle having a molten-steel introducing port, characterized in that the immersion nozzle is formed of a refractory material and a powdered metal having a desulfurizing ability, and part of the molten steel flowing through the molten-steel introducing port is desulfurized by a gas having a desulfurizing ability generated from the

powdered metal by heat of the molten steel, said part of the molten steel being present at the inner wall surface portion of the molten-steel introducing port.

33. The immersion nozzle according to claim 32, characterized in that the powdered metal having a desulfurizing ability is at least one powdered metal of Mg, Ca, Mn, and Ce, and at least one gas of Mg, Ca, Mn, and Ce is generated by the heat of the molten steel.

34. An immersion nozzle for steel continuous casting, said immersion nozzle supplying molten steel into a mold, the immersion nozzle having a molten-steel introducing port,

characterized in that the immersion nozzle is formed of a refractory material and at least one powdered metal of Mg, Ca, Mn, and Ce, and at least one gas of Mg gas, Ca gas, Mn gas, and Ce gas generated from said at least one powdered metal by heat of the molten steel is supplied to the molten steel flowing through the molten-steel introducing port.

35. The immersion nozzle according to claim 33 or 34, characterized in that the powdered metals of Mg, Ca, Mn, and Ce have a particle size of 0.1 to 3 mm, and the content of said at least one powdered metal of Mg, Ca, Mn, and Ce in the immersion nozzle is 3 to 10 mass percent.

36. A method for continuous casting of steel, comprising supplying molten steel into a mold using the immersion nozzle according to any one of claims 1 to 35.

37. The method according to claim 36, wherein the molten steel is poured into the mold without feeding an Ar gas to the molten steel flowing through a molten-steel introducing port of the immersion nozzle.

38. The method according to Claim 36, wherein, when the molten steel is an Al-killed steel containing no Ca, continuous casting is performed by feeding an Ar gas into the immersion nozzle at a flow rate of 3 NL/min or less (including 0).

39. A method for continuous casting of steel, comprising supplying molten steel into a mold using an immersion nozzle for continuous casting,

characterized in that a gas having a desulfurizing ability is supplied in the immersion nozzle so as to be injected into a molten-steel introducing port thereof from an inner wall surface of the immersion nozzle, whereby part of the molten steel flowing through the molten-steel introducing port is desulfurized, said part of the molten

steel being present at an inner wall surface portion of the immersion nozzle.

40. The method according to claim 39, wherein the gas having a desulfurizing ability is at least one gas of Mg gas, Ca gas, Mn gas, and Ce gas.

41. A method for continuous casting of steel, comprising supplying molten steel into a mold using an immersion nozzle for continuous casting,

characterized in that at least one gas of Mg gas, Ca gas, Mn gas, and Ce gas is supplied in the immersion nozzle so as to be injected into a molten-steel introducing port thereof from an inner wall surface of the immersion nozzle, and the gas is supplied to the molten steel flowing through the molten-steel introducing port.

42. A method for continuous casting of steel, comprising supplying molten steel into a mold using an immersion nozzle for continuous casting,

characterized in that the immersion nozzle is formed of a refractory material and a powdered metal having a desulfurizing ability, and part of the molten steel flowing through a molten-steel introducing port of the immersion nozzle is desulfurized by a gas having a desulfurizing

ability generated from the powdered metal by heat of the molten steel, said part of the molten steel being present at an inner wall surface portion of the immersion nozzle.

43. The method according to claim 42, wherein the powdered metal having a desulfurizing ability is at least one powdered metal of Mg, Ca, Mn, and Ce, and at least one gas of Mg gas, Ca gas, Mn gas, and Ce gas is generated by heat of the molten steel.

44. A method for continuous casting of steel, comprising supplying molten steel into a mold using an immersion nozzle for continuous casting,

characterized in that the immersion nozzle is formed of a refractory material and at least one powdered metal of Mg, Ca, Mn, and Ce, and at least one gas of Mg, Ca, Mn, and Ce generated from the powdered metal by heat of the molten steel is injected into a molten-steel introducing port so as to be supplied to the molten steel flowing therethrough.

45. The method according to claim 43 or 44, wherein the powdered metals of Mg, Ca, Mn, and Ce have a particle size of 0.1 to 3 mm, and the content of said at least one powdered metal of Mg, Ca, Mn, and Ce in the immersion nozzle is 3 to 10 mass percent.